



Morphometric Parameters of Histological Structures of the Spleen of White Rats in Postnatal Ontogenesis

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Abstract: This article is devoted to an urgent problem – the development of the spleen as an organ of the immune system at the stages of postnatal ontogenesis. In an experiment on 40 white mongrel male rats of 5 age groups using histological and morphometric methods followed by statistical analysis, data on the morphometric parameters of the spleen of white rats in postnatal ontogenesis are presented. It was found that the studied quantitative parameters of the white pulp of white rats undergo significant postnatal changes, expressed in different age aspects.

Key words: rats, spleen, white pulp, age-related changes, morphometric parameters.

Relevance. The immune system of humans and animals is one of the most sensitive systems of the body, which reacts quickly to external influences [6]. The largest peripheral organ of the immune system is the spleen [2; 5], one of the main functions of which is the formation of a generalized immune response to the effects of various pathogenic agents, which ensures the maintenance of immune homeostasis and, consequently, the necessary level of adaptive potential of the body (APO) [3; 5]. The immunocompetent compartment of the spleen parenchyma is represented by its white pulp (BP), where two main B- and T-dependent zones are formed, that is, areas of localization of mainly B and T lymphocytes. These are, respectively, lymphoid follicles (LF) and periarterial lymphoid couplings (PALM) [2; 4;5;7]. A large number of scientific studies have been devoted to the study of reactive changes in the spleen, in particular the structural elements of BP, based on the study of this organ both in humans [4;5;7] and various agricultural and laboratory animals [1;3;4]. Despite the existence of numerous modern studies on the structure of the spleen under the influence of external factors [6], the issues of morphofunctional changes in lymphoid formations of the spleen in the age aspect remain insufficiently studied. To accurately represent the reactions of the lymphoid structures of the spleen to any external stimuli or foreign elements, it is necessary to know the morphology of the lymphoid structures of the spleen normally.

The purpose of the study. To study the patterns of age dynamics of the features of the histological structure of the white pulp of the spleen of white mongrel rats in postnatal ontogenesis from birth to 12 months of age.

Materials and methods.

The study was performed on 40 white male mongrel rats, which were kept in vivarium conditions with a standard diet, free access to water, and a normal purification regime. The rats were divided into five age groups, 8 individuals each: Group 1 - newborns, group 2- 90 day old rats, group 3 - 180 day old rats, group 4- 270 day old rats, group 5 - 360 day old rats. The research was carried out in compliance with the rules of humane treatment of animals, which are regulated by the "Rules for carrying out work using experimental animals" approved by the Ethical Committee of the Bukhara State Medical Institute named after Abu Ali ibn Sino (No. 18 dated 01/16/2018), and were also based on the provisions of the Helsinki Declaration of the World Medical Association of 1964, amended in 1975, 1983, 1989, 1996, 2000, 2002, 2004, 2008, 2013 years .

For morphological examination, splenic fragments were fixed in a 10% formalin solution, passed through a battery of alcohols and poured into paraffin blocks according to generally accepted methods. Paraffin sections 5-8 microns thick were stained with hematoxylin – eosin. Histological and morphometric studies were performed using a LeicaCME microscope with a LeicaMicrosystemsCH-9435 digital camera. At the same time, the relative area of the white pulp (in %), the diameters of lymphoid nodules (in microns), germinative centers (in microns), the width of the mantle zone (in microns), the marginal zone (in microns) of lymph nodes were determined on sections of the tear.

Mathematical processing was performed directly from the general data matrix "Excel 7.0" using the capabilities of the program "STTGRAPH 5.1", the standard deviation and representativeness errors were determined.

The results and their discussion. In newborn white rats, the spleen is covered from the outside with a thin connective tissue capsule, from which trabeculae extend deep into the organ. The white pulp of the spleen in newborn white rats is just beginning to form. It is quite difficult to distinguish between periarterial lymphatic couplings and lymphoid nodules, mantle and marginal zones can be determined in the formed nodules. The study of histological preparations of other age groups of the spleen of white rats allowed us to establish certain relationships between its structural and functional zones. The spleen of white rats has a well-defined connective tissue capsule and trabeculae containing blood vessels. The parenchyma of the spleen of white rats is represented by red and white pulp. The composition of the red pulp includes sinusoidal capillaries and splenic cords. The white pulp consists of numerous lymph nodes and periarterial lymphoid couplings. The lymphoid tissue of the spleen, which forms a white pulp, on sections represents rounded or elongated gray areas among the red pulp filled with erythrocytes. The white pulp is a cluster of lymphocytes around an eccentrically located arterial canal. Morphometric parameters of the white pulp of the spleen of white rats by age are presented in the table. The relative area of the white pulp of the spleen of newborn white rats was $17.16 \pm 1.06\%$, the largest increase in this indicator was observed at 3 months of age ($22.2 \pm 1.72\%$), and the largest at 12 months of age ($12.32 \pm 1.08\%$). After 3 months of age, there is a decrease in this indicator. The diameter of lymph nodes increases by 1.92 times before the age of 3 months. After 3 months of age, this indicator also gradually decreases, where at 12 months of age it is 407.98 ± 8.18 microns. Germinal centers of lymph nodes in newborn white rats were not detected during histological sections, the greatest increase in this indicator was observed at 3 months of age (147.8 ± 7.66 microns), and the largest at 12 months (120.02 ± 5.36 microns). The width of the mantle zone increases by 1.32 times before the age of 6 months. After 6 months of age, this indicator also gradually decreases, where at 12 months of age it is 41.32 ± 1.12 microns. The width of the marginal zone and the periarterial zone from newborn age, in accordance with age aspects, began to increase to 6 months of age, starting from 6 months to one year of age decreased slightly.

The white pulp of the spleen of 3-month-old white rats is represented by well-defined lymph nodes and periarterial lymphoid couplings, among the lymph nodes nodules with germinative centers

predominate. In 3-month-old white rats, the width of the periarterial zone prevails over other indicators. In 9 and 12-month-old white rats, invasive changes prevail in lymph nodes and periarterial lymphatic couplings. The percentage of white pulp in newborn white rats is quite low. According to our data, the proportion of white pulp increased markedly in subsequent age groups. The largest values of the white pulp area were observed in the spleen of white rats at 3 months of age, in the initial age groups, the size of the white pulp steadily decreased, confirming the fact of age-related organ involution.

In terms of the area of the white pulp, the diameter of the lymph nodes and the diameter of the germinal centers, the greatest growth is observed at 3 months of age, and in terms of the width of the mantle zone, the width of the marginal zone and the width of the periarterial zone, the greatest growth is observed at 180 days of age.

With age, all the studied morphometric parameters gradually decrease and the lowest indicator is noted at 12 months of age.

Conclusions.

In the process of postnatal ontogenesis, the spleen of white rats undergoes structural and functional transformations reflecting the processes of formation of white pulp. In newborn white rats, the spleen is functionally immature, with hard-to-distinguish zones and poorly formed lymphoid nodules. At the age of three and nine months, the spleen has the maximum potential for immunogenesis. At one year of age, the processes of age-related organ involution begin, which manifest themselves in a change in the germinal centers of lymphoid nodules, a decrease in the number and area of lymphoid nodules and later the width of the mantle, marginal, periarterial zone in the white pulp of the spleen.

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